Research Article ISSN 2835-6276

American Journal of Medical and Clinical Research & Reviews

Brain Over Mind, Mind Over Brain: Cognitive Strategies for Regulating Brain Activity

Ashok Kumar Dudi

1. National Career Service Centre for Differently Abled, Ranchi, India.
2. Rehabilitation Council of India, New Delhi.
3. Indian Association of Clinical Psychologists, Bhiwadi, Rajasthan.
4. University of Rajasthan, Jaipur, India.

*Correspondence: Ashok Kumar Dudi

Received: 11 Dec 2024; Accepted: 16 Dec 2024; Published: 15 Jan 2024

Citation: Ashok Kumar Dudi. Brain Over Mind, Mind Over Brain: Cognitive Strategies for Regulating Brain Activity. AJMCRR 2024; 3(1): 1-13.

ABSTRACT

Research and results: *This study examines how meditation affects the brain utilizing fMRI, EEG-fMRI, machine learning, AI, molecular profiling, optogenetics, animal models, and clinical trials. It examines how meditation affects brain oscillations, connection patterns, and neurofeedback mechanisms and its therapeutic potential in Alzheimer's, epilepsy, Parkinson's, migraines, chronic pain, and mental health issues. Meditation increases brain structure, gray matter density, cortical thickness, and information processing speed. Meditation affects neurotransmitters, hormones, and the autonomic nervous system, regulating mood, attention, immunological function, and inflammation. Focus, emotion regulation, empathy, communal bonding, reduced inflammation, enhanced productivity, and illness mitigation are also discussed in meditation.*

Aim: *This study endeavors to inform mental health patients and healthcare providers about the benefits of meditation as a therapy for mental diseases.*

Methods and tools: *A professional psychologist who self-healed from schizophrenia found that meditation may help. Personal experience and literature evaluation inform the research, which includes peer-reviewed papers and empirical research. Psychology ethics provide anonymity and informed consent in the study. The data confirm meditation's therapeutic and mental health effects.*

Conclusion: *The study advances meditation science and lays the groundwork for mental health clinical trials.*

Keywords: Autonomic Nervous System, Brain Waves, Gut Microbiota, Hippocampus, Inflammation, Metaphysical, Neuroinflammation.

Introduction

Humans have sought to comprehend their minds since the birth of civilization. We balance our intelligence and mental health issues as we move through history. Our intellect has driven us to unprecedented creativity, but it has also haunted our inventors. Civilization brought stress, worry, and the goal of perfection, which created a complex web of mental health issues.

As we enter the 21st century, the human intellect faces a crossroads where progress has brought both new wonders and new trials. In this day of information overload and daily life responsibilities, mental wellness is a top priority. The intellect that once advanced us now threatens our mental health, necessitating holistic remedies.

Meditation, a timeless discipline from ancient wisdom, guides us to mental balance. It calls us to rediscover the quiet within, to explore our consciousness, and to find peace in the chaos. This scientific inquiry delves into meditation's mysteries and its significant effects on the human psyche. Our research spans neuroscience, psychology, and spirituality to understand meditation's mechanics and reveal its potential to improve mental health. Scientific inquiry underpins our search, not esoteric spirituality. Meditation helps us connect ancient wisdom and modern science, which may help the human mind and modern life coexist.

Methodology

Meditation may help schizophrenia patients recover themselves, according to a recent study. A professional psychologist who self-healed from schizophrenia after 20 years of introspection offers a unique viewpoint on meditation's therapeutic possibilities. The process is precise, combining personal experience with a Scholar, Google, PubMed, and other literature reviews. His introspective experience and profound awareness of mental health issues give the researcher a nuanced perspective on meditation's effects.

A comprehensive literature search using peer-reviewed publications, empirical research, and theoretical frameworks Personal introspection and literature review findings are synthesized to understand meditation's therapeutic potential. The research follows psychology ethics, assuring participant anonymity, informed consent, and responsible dissemination. This study adds to the data supporting meditation's therapeutic benefits and may affect mental health.

Integrating neuroscience and meditation research for transformation

Meditation and neuroscience could transform several disciplines. Meditation's brain underpinnings can help explain its mind-body effects, increasing acceptability. Meditation for stress reduction and attention increase can be optimized using neuroscience (Tang, 2017). In neuroscience-based treatments for psychiatric and neurological problems, brain changes from different meditative states could reveal consciousness. Meditation causes neuroplasticity, illustrating how experience chang-

es the brain (Guidotti et al., 2021). Meditation may help develop neurofeedback by revealing brain oscillations and connection patterns. Meditation's cognitive benefits may encourage academics to teach contemplative practices to increase learning and focus. Meditation tailored to brain shape and function could improve precision medical outcomes based on neuroscience (Tang, 2017).

Neuroscience of meditation

Meditation alters brain networks that regulate attention, emotion, self-awareness, and executive control. Not all mechanisms are understood. Neuroimaging tools like fMRI, EEG, and MEG map these changes, but technology limits spatiotemporal resolution. Studies demonstrate group-level differences between meditators and non-meditators, making within-subject improvements difficult to track. Few causal links exist between brain changes and behavioral assessments, but correlations are often used. Monitoring brain changes during meditation against a baseline is necessary to determine transitory effects (Tang & Tang, 2020).

Neuroscience reveals meditation's intricacies

Neuroscience can illuminate meditation's intricacies. Ultra-high-field fMRI can map brain areas and network activity during meditation. Multimodal techniques like EEG-fMRI can link brainwave variations to neuronal activity. Advanced data analytics employing machine learning and AI can uncover biomarkers and neural signatures of distinct practices, while molecular profiling can identify molecular causes. Longitudinal studies can determine meditation-induced modifications vs. self-selection differences. Optogenetics can influence meditation-related neurons using light, while animal models can research meditation's benefits. Clinical investigations and real-time neurofeedback can reveal meditation-induced brain alterations (Church, 2022).

Medical benefits of meditation for neurological conditions

Meditation improves cognitive performance, slows atrophy, and lowers beta-amyloid plaques in Alzheimer's patients. In some epilepsy types, regulating excitatory and inhibitory signaling may lower seizure frequency. Meditation may help post-stroke cognitive, motor, and speech recovery by boosting neuroplasticity. Yoga meditation may alleviate Parkinson's patients' motor symptoms, sadness, and sleep by modulating dopamine systems. Mindfulness and relaxation are proven to lessen migraine frequency, pain, and quality of life. Meditation reduces the symptoms of multiple sclerosis and post-concussion syndromes (Farias et al., 2021).

Meditation Alters Brain Structure and Neuroplasticity

Meditation changes brain shape and neuroplasticity dramatically. It boosts hippocampus gray matter density, which regulates learning, memory, and emotion. Studies reveal meditators have a bigger hippocampus. Meditation lowers age-related frontal brain thinning, which affects focus, decision-making, and mood. It increases insula thickness, which regulates self-awareness and emotions. Meditation promotes prefrontal cortex folding, speeding information processing, and improving attention. Strengthening brain network connections, particularly those between the prefrontal cortex and limbic areas, results in better emotion control. Meditation also boosts myelination, which speeds up brain networks. The cognitive and emotional benefits of meditation are attributed to these structural alterations (Tang & Tang, 2020).

Neurotransmitter-altering meditation

Various meditation approaches affect neurotransmitter systems. Focused attention (FA) meditation boosts motivation and the pleasure chemical dopamine. Open monitoring (OM) meditation boosts serotonin, which affects mood, sleep, hunger, and cognition. Loving-kindness meditation releases oxytocin, the social bonding love hormone. Transcendental meditation boosts melatonin, which governs sleep and circadian rhythm. Mindfulness meditation may reduce anxiety by changing GABA levels, a neurotransmitter with inhibitory and soothing effects. Overall, meditation states impact neurotransmitters that affect mood, attention, empathy, sleep, and more. Prolonged practice may alter basal neurotransmitter levels and function (Zelazo et al., 2007).

Meditation's autonomic effects

Meditation has major effects on the autonomic nervous system, which controls involuntary body functions. It promotes the relaxation, digestion, and recuperation of the parasympathetic nervous system. Meditation suppresses the fight-or-flight sympathetic nervous system. This lowers blood pressure, respiration, adrenaline, and cortisol. Heart rate variability (HRV) improves with meditation, indicating autonomic flexibility. Meditation dramatically lowers stress-induced sympathetic activity-stimulated inflammatory biomarkers, including cytokines. Meditation also raises alpha and theta brain waves, balancing sympathetic and parasympathetic activity. These effects mitigate chronic stress's autonomic nervous system consequences. Meditation boosts autonomic balance, flexibility, and emotional control (Park et al., 2022).

Meditation therapies for autonomic dysfunction

Meditation can be used to treat autonomic dysfunction. Reduces sympathetic activity and increases parasympathetic tone to decrease hypertensive blood pressure. It can also moderate increased sympathetic arousal in anxiety disorders, especially mindfulness meditation. It can also assist trauma survivors in controlling hypervigilance and emotions generated by a hyperactive sympathetic system by soothing the parasympathetic system. Meditation helps alleviate Irritable Bowel Syndrome (IBS) symptoms by harmonizing the sympathetic and parasympathetic nervous systems. It can also start the rest and digest response, making sleep simpler. Meditation boosts parasympathetic activity, which reduces depression symptoms (Arpaia & Rapgay, 2012).

Meditation affects neuroplasticity and brain structure

Meditation changes brain shape and neuroplasticity dramatically. It boosts hippocampus gray matter density, which regulates learning, memory, and emotion. Studies reveal meditators have a bigger hippocampus. Meditation also lowers age-related frontal brain thinning, which affects focus, decision-making, and mood. The self-awareness and emotional regulation insula are thicker. Cortical folding in the prefrontal cortex speeds up information processing and improves focus. Stronger brain network connections, such as between the prefrontal cortex and limbic areas, may improve emotion regulation. More myelination creates more efficient and focused brain pathways, speeding nerve impulse travel. The cognitive and emotional benefits of meditation are attributed to these structural alterations (McJenna, 2023).

Meditation regulates immunological and inflammatory responses

Meditation improves immunity and reduces inflam-

mation. It decreases pro-inflammatory cytokines, promotes anti-inflammatory signaling, lowers inflammatory markers, and boosts the immunization antibody response. Meditators have reduced baseline inflammatory markers and enzymes. Meditation lowers pro-inflammatory gene expression. Stress and inflammation can shorten telomeres, which cause cellular aging. Meditation may prevent this. Meditation boosts melatonin, which causes sleep and reduces inflammation. Meditation has been demonstrated to improve immune function and inflammation by reducing inflammatory pathways, increasing antibody responses, and encouraging anti-inflammatory signaling (Mace, 2022).

Meditation regulates hormones and metabolism

Meditation profoundly affects hormone control and metabolism. It lowers the stress hormone cortisol, which raises blood sugar and fat storage. This reduces adrenal cortisol, which boosts metabolism. Meditation boosts growth hormone, which regulates muscle and bone mass and burns fat. Lowering cortisol and adrenaline, which elevate glucose, lowers blood glucose in healthy and diabetic people. Meditation lowers blood glucose and cortisol, improving glucose metabolism and insulin sensitivity. Leptin sensitivity increases, regulating hunger and satiety. Meditation reduces thyroid hormone T4, improving thyroid function and metabolism. Finally, meditation increases melatonin, which regulates metabolism and circadian cycles (Arif, 2023).

Meditation affects the gut microbiome

Meditation may affect the gut microbiota, our billions of microorganisms, according to research. Improvements in variety, inflammation, and beneficial microorganisms are possible. Regular meditators have more beneficial bifidobacteria and fewer disease-causing bacteria. Meditation reduces stress hormones, which affect gut permeability and microbiota balance. Meditation can affect the gut-brain axis, which depends on neurotransmitter signaling. Meditation improves nutrition and sleep, which alter the gut microbiome. Meditation also reduces the gut fight-or-flight sympathetic tone, which helps relieve IBS symptoms like constipation. However, more solid clinical trials are needed to properly understand meditation's gut microbiota benefits (Faraji-Rad, 2023).

Meditation benefits

Transcendental meditation, which involves mantras and deep breaths, activates the vagus nerve, improving mental health through emotional, physical, social, and vocational ties. Meditation helps you understand your consciousness and succeed in life.

Emotional benefits:

Meditation improves focus, blood pressure, and emotional tranquility. The revelation of concealed thoughts and feelings brings tranquility, emotional security, and control. Meditation affects the prefrontal cortex and amygdala, which store memories and are disorganized in severe mental diseases like schizophrenia. Meditation can rebuild brain tissues, enhance hippocampus gray matter, and diminish the amygdala fear center, reducing fear and enhancing safety (REN et al., 2013).

Mental exercise reduces brain waves and insomnia -like psychopathological issues, promoting deep sleep. It promotes 8-hour sleep and reduces oversleeping. Regular relaxation strategies, like meditation, can help with ADHD. Spiritually stimulating unpleasant sensations and releasing inner nois-

es can help people move forward and abandon bad notions. Mindfulness techniques like STOP can reduce anger and increase patience (REN et al., 2013).

Reduced concern about mistakes and defects helps you get through tough situations and become a community booster. Meditation boosts self-esteem and self-realization by developing God's appreciation. Inward focus and attention free people from thoughts and enable them to realize themselves. Mental and emotional competence enables people to create their reality, with transcending vibrations emerging in physical and tangible substance (REN et al., 2013).

Physiological benefits:

Mindful breathing improves survival, emotion management, and oxygen and carbon dioxide exchange. Focusing on healing needs enhances the body's greatest senses. Meditation helps chronic pain patients survive by stimulating pain treatment regions. Chronic stress can cause weight gain, heart disease, stroke, and diabetes. These techniques reduce stress and boost health (Fujino, 2023).

Occupational benefits:

Mindful meditation can reduce inflammation, improve concentration and memory, boost sleep, and relax. A "chain reaction" of mental improvements from consistent meditation improves productivity in daily duties. Meditation improves physical, mental, and emotional wellness and career prospects. It improves mental and emotional control, limiting violent decisions and abrupt behavior and reducing mistakes through better judgment (Abee, 2020).

Meditation helps people handle unhappiness without grumbling, promoting career advancement. It eliminates negative ideas and promotes good life changes, helping people identify their needs and develop goals with targeted effort. Over time, disciplined meditation can improve awareness, allowing multitasking and success in all areas (Abee, 2020).

Body responses and mental maneuvering diffuse stressful times before they intensify. The controlled mind integrates with the body by enabling the right inarticulate experience and soothing brain conversation. Meditation increases mind-body concentration and energetic position for cosmic power connection. Mindfulness boosts metabolism, preventing cancer, menopause, high blood pressure, and metabolic diseases, according to research (Abee, 2020).

Body molecules modify gene expression, delaying aging and making the brain younger and healthier. Mindful bodily connection enhances sexual fulfillment and desire. Professional mental presence motivates oneself to get up and exercise with heightened awareness. Meditation helps reduce chronic health disorders like high blood pressure, heart disease, and arthritis. An improved immune system leads to better health and a longer lifespan. Energy, happiness, endorphin release, and cortisol levels improve (Abee, 2020).

Social benefits:

Meditation promotes empathetic brain connections, improves social skills, and fosters community relationships. It also develops feeling-related habits that boost generosity. Meditation improves mood and self-awareness, helping people take responsibility for their actions. Meditation boosts energy for better workouts. It improves affinity and friendliness, making conversation easier and promoting communal adaptation. Meditation deepens and en-

riches relationships. Overall, meditation boosts personal growth and well-being (Watson et al., 2023).

Financial benefits:

Meditation helps practitioners develop clear goals and financial insights to better manage their finances (Cheung, 2007).

Psychological benefits:

For focus and mental health difficulties, meditation is powerful. It helps people handle boring and impatient situations by building tolerance and inner power. Meditation promotes passive observation of emotions, creating a seat of awareness within. This practice cultivates self-love and spiritual awareness for oneself and others. Meditation calms wind adoration increases awareness of new ideas, and calms the hyperactive and confused mind. Inner tranquility promotes self-purity, chastity, confidence, creativity, and memory. It promotes peace, minimizes isolation, and gives mental health professionals logical variety and happiness (Palmer & Finlay, 2003).

Meditation improves depression by managing negative thoughts and encouraging self-diagnosis. It reduces self-criticism and self-judgment, promoting knowledge and consensus. Meditation helps see alternative solutions to practical problems. Current mental disorder patients release cortisol in reaction to perceived fear or danger due to medial prefrontal cortex (mPFC) hypoactivity and overdrive. Continuous meditation helps treat persistent mental illnesses by restoring brain synchronization (Shaha & Gupta, 2018).

Meditation, pranayama, hypnosis, biofeedback, autogenic training, progressive muscle relaxation, Qi Gong, Tai Chi, and yoga all cause the body to release endorphins, which calm down the *fight or flight* response that comes up when you are under too much mental stress. Yvonne Greene and Bryan Hiebert examined how productiveness, meditation, and cognitive self-observation affect mental health and well-being. These strategies raise self-awareness and assist in correcting maladjusted thoughts with greater inner-directedness (Anālayo, 2021).

Meditation techniques

Meditations differ in psychological, emotional, cognitive, and physiological qualities based on empirical or therapeutic factors. Some meditations improve relaxation, catharsis, calmness, euphoric bearing, attention and concentration, internal sensations, ideas, and emotions, with distinct benefits.

Mindfulness meditation

A mindfulness-based stress reduction (MBSR) approach for psychiatric diseases by Jon Kabat-Zinn emphasizes meditation and mindfulness. The practice entails sitting quietly, focusing on breathing, and monitoring ideas without responding. The person focuses on each breath and ignores internal feelings, ideas, and cognitions. Refocusing to sense breath eventually takes control of the mind when thoughts distract (Seo, 2023).

Simple meditation

Sitting quietly, closing your eyes, and focusing on a neutral word or phrase improves concentration. Calming the thoughts and focusing on the word or phrase helps. Exhale and repeat the word or phrase if stressed. Repeat when the focus is disrupted. It disrupts the link between a tense body and stressed thoughts. Give yourself some time and slowly open your eyes after a moment (Sharma et al., 2022).

Transcendental meditation

Transcendental meditation, developed by Maharshi Mahesh Yogi, uses religious and spiritual chants to improve attention. According to Dr. Herbert Benson's research at Maharshi University of Management, Iowa, reaching the source of these concepts leads to complete consciousness and a pleasant state of transcendence in the body and mind (Panbilnathan, 2022).

Vipassana and Samatha meditation

An ancient Indian meditation method, vipassana, was used 2500 years ago to treat many diseases. In Syagyi U Ba Khin, S. N. Goenka teaches this technique. Vipassana—observing things as they are—is based on Pali and modern Theravada literature. Vipassana meditation focuses on one thing and prevents thoughts from wandering, culminating in complete mental tranquility and release into a revolutionary state (Dhakhwa, 2022).

Relaxation response

Benson is starting muscular relaxation meditation to diminish physiological eroticism and achieve hypometabolism. The hypothalamic reaction reduces sympathetic levels and switches primacy to the parasympathetic system. This exercise integrates counting with outer breathing to ignore bothersome thoughts and count from one to the next ("Antioxidants Effect Changes in Systemic Parasympathetic and Sympathetic Nervous System Responses and Improve Outcomes," 2020).

Yogi Nidra or Yoga Meditation

One feels intense conscious relaxation and awareness while following verbal cues in yoga meditation. Sankalpas, where one self-resolves their deepest aspirations, start the process. "Pratyahara," or sense removal, brings order and intensity to the inner world. Brain activity decreases during healing, liberating time, space, and reason. The ultimate goal of Yog Nidra is *Samadh*i, contemplative consciousness (Kanitkar & Datta, 2023).

Mantra meditation

Mantras are multilingual words with spiritual sounds, words, phrases, or syllables considered to have magical abilities and tranquilizing vibrations. Practitioners can chant these mantras to focus on intentions and change material reality. Mantras can lessen brain activity and thinking. Mantras can have meaningful meanings and grammatical structures, and the desired voice or one that makes you happy can be added to soothe or delight. Mantras can boost mental function, present awareness, and prevent cognitive decline. It dissolves energy blockages, increasing alpha waves that soothe the mind and body, lowering fatigue and anxiety, enhancing mood and memory, and promoting mental health and well-being (Saini & Sorout, 2023).

Kriyakirtan meditation

Bhajan founded Sa Ta Na Ma Meditation, also known as sound meditation or vibrating meditation, and Niranjan Das teaches it in India. It involves noise to calm down and relieve stress. A word with alternative consonants and vowels is shouted to draw attention. Reverberation represents the body's path through creation, life, death, and kindness. Awareness-based rebirth and generosity are requested. Achieving electromagnetic harmony through electrical polarity vibrations promotes inner peace and kindness ("Three Types of Five-Sense Meditation," 2019).

Kundalini meditation or Taoist meditation

Hinduism and Buddhism, especially Upnishadas and Shaiva Tantra, teach Kundalini energy, the old-

est recorded experience. This divine feminine energy, stemming from Muladhara's snake strength, is thought to provide effective life energy. Full potential, creativity, and greater life energy lead to spiritual enlightenment when joined with cosmic and universal consciousness. It can kill or cure, making it a dangerous and beneficial thing. Tantra, Kundalini yoga, and Hath yoga are powerful ways to awaken and connect the serpentine Kundalini divinity with the cosmic life force (Volodina et al., 2021).

After inhaling essential evolving life energy, follow the Central Great Axis to the base of the spine and activate psychic centers or chakras to the crown chakra or head to awaken the Kundalini. Nadis surge with energy, boosting consciousness. One can mentally replay the powerful seed tune "Aum" to turn the body into mystical spiritual senses if one is in a Shiva-spirit merger and full of Shakti. Sex, dancing, shaking, and Shaktipat—magical contact with a Guru, mantra, sight, or word—can also activate this energy (Volodina et al., 2021).

Body scan meditation

This meditation requires resting down, uncrossing legs and arms, and breathing. The mind is guided to each body component to harmonize sensations. The practice switches to another area after a few minutes and focuses on the full body. Visualizing the breath from toe to the universe connects the mind to the breath and universe. This meditation promotes body harmony and attention (Kogan & Bussolari, 2021).

Walking meditation

Walking meditation requires paying attention to every stride and redirecting thoughts to body emotions. Walking and breathing awareness promote balance and alertness. The whole body feels its legs and feet as it observes movement. In his Stress Reduction Clinic at the University of Massachusetts Medical Centre, Dr. Jon Kabat-Zinn found this technique to reduce stress (Kabat-Zinn, 2016).

Clinically standardized meditation (CSM)

Carrington (1977) created Mantra Meditation, which lets students choose from sixteen Sanskrit mantras. With eyes open, the meditation entails slowly repeating the mantra to oneself and observing its voice. Whispering the mantra brings it to mind. For silent or loud mantra perception, this meditation produces a cheerful and serene environment (Saini & Sorout, 2023).

Microcosmic orbit meditation

Taoist microcosmic orbit meditation swirls internal energy in an orbit by generating the governing channel and conception channel. First, sit quietly with normal breathing and closed eyes. Focus on the umbilical region, visualize flowing energy from the perineum to the coccyx, up to the Jade Pillow, influence the head in the Nirvana Chamber, and focus on the celestial eye in the eyebrows. After passing through the palate, tongue, throat, heart, and genitals, the energy enters the root and lower elixir field into the solar plexus. Repeat this cycle of energy drive to the brain to fill the Governing Channel and Conception Channel with vital energy that energy meridians send to the body's primary units (Volodina et al., 2021).

Central channel meditation

Master Han Yumo created a technique in Canada and China at Sung Yang Tango Centers. The method entails sitting comfortably, breathing, and anticipating a beam of energy to enter the Medicine Pal-

ace, the head's crown. Energy flows through the Central Channel to the Lower Elixir Field and back to the Medicine Palace. The scalp opens and closes like valves, suggesting energy flow. Head-shackling and body-rocking indicate energy excitement and powerful channel opening (Naragatti, 2020).

Challenges, research directions, and ethical issues

Meditation's brain effects are difficult to investigate because of participant differences, technology limitations, tracking adherence, active controls, cause and effect, state versus trait, mechanistic understanding, and comorbidities. Meditation techniques vary widely, making it hard to recruit homogeneous groups. MEG costs more and demands more attention than fMRI. Actively controlling meditation's effects is tough yet vital. Animal and chemical models can explain benefits, but lifestyle, personality, and past experiences are difficult to disentangle.

Future meditation research can examine brain alterations using multimodal imaging, neurotransmitters, hormones, and gene expression. Control groups using sham meditation, relaxation, and breath focus can isolate meditation's effects. Animal mimicry is a useful tool for studying brain changes. In complicated neural-behavioral interactions, AI and machine learning can uncover patterns. Effects of meditation frequency, duration, and length can explain brain patterns. Meta-analyses and large data methodologies benefit from database sharing and individualization. Please avoid generalizing effects, respect participants' ideas, maintain high standards, safeguard privacy, avoid forcing participation, communicate responsibly, disclose conflicts of interest, and support equal access. Research should respect participants' spiritual beliefs, and all socioeconomic levels should have access to evidence-based meditation.

Conclusion

Meditation increases gray matter density and cortical thickness in the prefrontal cortex, hippocampus, and insula, brain network connectivity, emotional regulation, relaxation, and attentional focus. Serotonin, dopamine, and GABA levels drop, as do stress hormones and sympathetic nervous system activity. Also affected are inflammatory pathways, immune cell gene expression, and endocrine function. Attention, memory, and executive function improve with structural alterations. Neuronal and physiological responses to stimuli are slowed down during meditation. There are also long-lasting changes in brain structure and function compared to people who do not meditate.

Conflict of interests: None to be reported.

Funding statement: No funding was received for writing this manuscript.

References

1. Tang, Y. Y. (2017, August 9). The Neuroscience of Mindfulness Meditation. Springer. http://books.google.ie/books?id=X2AwDwAAQBAJ&printsec=frontcover&dq=Meditation+for+stress+reduction+and+attention+increase+can+be+optimized+using+neuroscience&hl=&cd=2&source=gbs_api
2. Guidotti, R., Del Gratta, C., Perrucci, M. G., Romani, G. L., & Raffone, A. (2021, August 18). Neuroplasticity within and between Functional Brain Networks in Mental Training Based on Long-Term Meditation. Brain Scienc-

es, 11(8), 1086. https://doi.org/10.3390/brainsci11081086
3. Tang, Y. Y., & Tang, R. (2020, February 21). The Neuroscience of Meditation. Academic Press. http://books.google.ie/books?id=CTfSDwAAQBAJ&printsec=frontcover&dq=Neuroscience+of+meditation&hl=&cd=2&source=gbs_api
4. Church, D. (2022, March 22). Bliss Brain. Hay House, Inc. http://books.google.ie/books?id=NkxLEAAAQBAJ&pg=PA322&dq=Neuroscience+can+reveal+meditation-induced+brain+alterations.&hl=&cd=1&source=gbs_api
5. Farias, M., Brazier, D., & Lalljee, M. (2021, October 21). The Oxford Handbook of Meditation. Oxford University Press. http://books.google.ie/books?id=ENJGEAAAQBAJ&printsec=frontcover&dq=Medical+benefits+of+meditation+for+neurological+disorders&hl=&cd=1&source=gbs_api
6. Kral, T. R. (2020, January 1). Impact of Mindfulness Meditation on Brain Function, Connectivity, and Structure. http://books.google.ie/books?id=kFygzQEACAAJ&dq=Meditation+Alters+Brain+Structure+and+Neuroplasticity&hl=&cd=3&source=gbs_api
7. Zelazo, P. D., Moscovitch, M., & Thompson, E. (2007, May 14). The Cambridge Handbook of Consciousness. Cambridge University Press. http://books.google.ie/books?id=o9ZRc6-FDg8C&printsec=frontcover&dq=Meditation+practice+may+alter+basal+neurotransmitter+levels+and+function.&hl=&cd=1&source=gbs_api
8. Park, C., Youn, I., & Han, S. (2022, December 29). Single-lead ECG based autonomic nervous system assessment for meditation monitoring. Scientific Reports, 12(1). https://doi.org/10.1038/s41598-022-27121-x
9. Arpaia, J., & Rapgay, L. (2012, May 18). Real Meditation in Minutes a Day. Simon and Schuster. http://books.google.ie/books?id=58c6AwAAQBAJ&printsec=frontcover&dq=Meditation+therapies+for+autonomic+dysfunction&hl=&cd=1&source=gbs_api
10. McJenna, S. S. (2023, June 17). Neural healing of psyche and neuroplasticity. Jurij Statjow. http://books.google.ie/books?id=bs3FEAAAQBAJ&pg=PT15&dq=Meditation+affects+neuroplasticity+and+brain+structure&hl=&cd=7&source=gbs_api
11. Mace, S. (2022, September 28). Healing the Gut. Independently Published. http://books.google.ie/books?id=LiRizwEACAAJ&dq=Meditation+regulates+immunological+and+inflammatory+responses&hl=&cd=1&source=gbs_api
12. Arif, A. (2023, March 26). HORMONAL HARMONY. CUREYA. http://books.google.ie/books?id=UK61EAAAQBAJ&printsec=frontcover&dq=Meditation+regulates+hormones+and+metabolism&hl=&cd=5&source=gbs_api
13. Faraji-Rad, M. (2023). Gut Instinct: How the Microbiome Affects Traumatic Brain Injury, A Narrative Review. International Journal of Surgery & Surgical Techniques, 7(1), 1–7. https://doi.org/10.23880/ijsst-16000182
14. REN, J., HUANG, L., & ZHANG, Z. X. (2013, April 16). Meditation Makes A Peaceful State of Mind: People's Positive and Negative Emotional Response Can Be Reduced by Meditation Training. Acta Psychologica Sinica, 44

(10), 1339–1348. https://doi.org/10.3724/sp.j.1041.2012.01339
15. Fujino, M. (2023, October). Understanding Mindful Awareness in Mindfulness Meditation--Investigation of the Psychological, Physiological, and Neural Mechanisms of Mindfulness Meditation. NTT Technical Review, 21(10), 20–25. https://doi.org/10.53829/ntr202310fa3
16. Abee, B. (2020, July 6). The Amazing Benefits of Meditation: Living the Life You've Always Wanted to Live. Energetic Wave Publishing. http://books.google.ie/books?id=EIfvDwAAQBAJ&printsec=frontcover&dq=Occupational+benefits+of+meditation&hl=&cd=3&source=gbs_api
17. Watson, T., Watts, L., Waters, R., & Hodgson, D. (2023, October 23). The Benefits of Loving Kindness Meditation for Helping Professionals: A Systematic Review. Health & Social Care in the Community, 2023, 1–14. https://doi.org/10.1155/2023/5579057
18. Cheung, F. (2007, October 31). Mental training: The benefits of short-term meditation. Nature China. https://doi.org/10.1038/nchina.2007.226
19. Palmer, M., & Finlay, V. (2003, January 1). Faith in Conservation. World Bank Publications. http://books.google.ie/books?id=wbvw7YQ2Y2MC&printsec=frontcover&dq=Meditation+calms+wind+adoration+increases+awareness+of+new+ideas,+and+calms+the+hyperactive+and+confused+mind.+Inner+tranquility+promotes+self-purity,+chastity,+confidence,+creativity,+and+memory&hl=&cd=1&source=gbs_api
20. Shaha, R., & Gupta, S. (2018, April 6). Role of Rajyoga meditation as a psychotherapy in various physical and mental illnesses and well-being. Indian Journal of Positive Psychology, 9 (01). https://doi.org/10.15614/ijpp.v9i01.11753
21. Anālayo, B. (2021, July 10). Dimensions of the 'Body' in Tranquility Meditation. Mindfulness, 12(10), 2388–2393. https://doi.org/10.1007/s12671-021-01659-9
22. Seo, B. N. (2023, April 30). Intervention protocol : Mindfulness-based stress reduction (MBSR) and yoga for insomnia accompanied by hypertension. Quality of Life Research, 1(1), 21–32. https://doi.org/10.59434/jqolr.2023.1.1.021
23. Sharma, K., Wernicke, A. G., Rahman, H., Potters, L., Sharma, G., & Parashar, B. (2022, March 28). A Retrospective Analysis of Three Focused Attention Meditation Techniques: Mantra, Breath, and External-Point Meditation. Cureus. https://doi.org/10.7759/cureus.23589
24. Panbilnathan, A. (2022, June 1). Effects of Different Types of Meditations Namely Transcendental Meditation and Heart Rhythm Meditation on Selected Physiological Variable. JOURNAL OF ADVANCED RESEARCH IN AYURVEDA, YOGA, UNANI, SIDHHA & HOMEOPATHY, 09(1 & 2), 16–18. https://doi.org/10.24321/2394.6547.202206
25. Dhakhwa, S. B. (2022, October 10). The Principles and the Method of Vipassana Meditation. Journal of Population and Development, 3(1), 151–157. https://doi.org/10.3126/jpd.v3i1.48816
26. Antioxidants Effect Changes in Systemic Parasympathetic and Sympathetic NervousSystem Responses and Improve Outcomes. (2020, April 16). Cardiology: Open Access, 5(1). https://doi.org/10.33140/coa.05.01.05
27. Kanitkar, M., & Datta, K. (2023). Using Yoga Nidra practice as Nidra enhancing strategy: A

perspective. Journal of Research in Ayurvedic Sciences, 7(3), 178. https://doi.org/10.4103/jras.jras_68_23

28. Saini, R., & Sorout, J. (2023, July 14). Literature Review on Mantra Meditation. Medical and Health Science Journal, 7(01), 40–45. https://doi.org/10.33086/mhsj.v7i01.3456
29. Three Types of Five-Sense Meditation. (2019). Journal of Meditation Based Psychological Counseling, 21. https://doi.org/10.12972/mpca.20190013
30. Volodina, M., Smetanin, N., Lebedev, M., & Ossadtchi, A. (2021, December 2). Cortical and autonomic responses during staged Taoist meditation: Two distinct meditation strategies. PLOS ONE, 16(12), e0260626. https://doi.org/10.1371/journal.pone.0260626
31. Kogan, L. R., & Bussolari, C. (2021, July 16). Exploring the Potential Impact of a Virtual Body Scan Meditation Exercise Conducted With Pet Dogs on Recipients and Facilitators. Frontiers in Psychology, 12. https://doi.org/10.3389/fpsyg.2021.698075
32. Kabat-Zinn, J. (2016, November 15). Walking Meditations. Mindfulness, 8(1), 249–250. https://doi.org/10.1007/s12671-016-0638-1
33. Saini, R., & Sorout, J. (2023, July 14). Literature Review on Mantra Meditation. Medical and Health Science Journal, 7(01), 40–45. https://doi.org/10.33086/mhsj.v7i01.3456
34. Volodina, M., Smetanin, N., Lebedev, M., & Ossadtchi, A. (2021, December 2). Cortical and autonomic responses during staged Taoist meditation: Two distinct meditation strategies. PLOS ONE, 16(12), e0260626. https://doi.org/10.1371/journal.pone.0260626
35. Naragatti, S. (2020, October 8). Necessity and Significance of Meditation in Life. JOURNAL OF ADVANCED RESEARCH IN AYURVEDA, YOGA, UNANI, SIDHHA & HOMEOPATHY, 07(3 & 4), 27–30. https://doi.org/10.24321/2394.6547.202010